

Components of an IPM Program

The following description of integrated pest management was excerpted from an article in *Common Sense Pest Control Quarterly*, a publication of the Bio-Integral Resource Center (BIRC). For a free publications catalog, contact BIRC, PO Box 7414, Berkeley, CA 94707.

An IPM program contains the following key components:

1. Initial Information Gathering

Obtain an identification of the pest and/or problem. The scientific name of an organism is the key to all that has been written about the pest in the past. Examine the literature on the biology of the pest and its management. Interview local management personnel on the history of pest management at the site as well as other activities that might influence the pest problem. Information collected on the background of the problem, plus records of ongoing activities once the program begins, provide the basis for intelligent program continuity.

2. Monitoring

Observe the plants, or site, for potential pest problems at regular intervals (see Monitoring below for full details).

3. Establishing Injury Levels

Determine when the pest problem is likely to become serious enough to require some action.

4. Record-keeping

Keep records of what is seen, decisions made, actions taken, and results. Records are the memory of a system. When personnel leave their experience is lost if there are no records.

5. Least-toxic treatments

Select pest management approaches and specific methods according to the criteria spelled out below. Confine the treatments in time and place (i.e., use spot treatments) to minimize ecosystem disruptions. A summary of treatments strategies is provided below.

6. Evaluation

Inspect after treatment action has been taken. Write down what you learn. Has the treatment been worthwhile? How can the whole process be improved to achieve the overall objectives of the program?

Monitoring

This involves regular inspections of the areas where pest problems might occur, and keeping records of what you observe. It means paying close attention to specific animal, plant, or microbial populations as well as to human behavior and weather. But a practical monitoring system does not need to meet the stringent requirements of a research project. Each monitoring system needs

to be tailored to the particular situation, i.e., the level of effort should be appropriate to the amount of serious damage caused by the pest, the time available, and the skill level of the person who will be making the inspections, etc.

Monitoring a small system, such as a residential kitchen with a cockroach problem, may only require quick bi-weekly inspections of sticky traps used to track the rise or fall of roach populations. In large systems such as parks, wholesale nurseries, farms, or forests, where intolerable economic damage may result if pest populations are not controlled, a full-scale monitoring program may be required.

This not only involves recording the population size of key pests and their natural enemies, but also may involve keeping track of other potential pest populations and their natural enemies. The impact of cultural practices such as fertilizing, irrigating, pruning, and mowing on pest populations must be analyzed. The influence of heat, humidity, and such weather phenomena as rain, wind, and flooding on pest population size should also be taken into account.

Management of garbage and domestic animals, as well as other human behaviors affecting household pests, may need to be monitored. Any of these factors may need to be recorded; the decision will depend on the purpose for which the monitoring is undertaken.

Developing A Monitoring Program

Here are some suggestions for both the lay public and the professional consultant on how to develop a monitoring and record-keeping system:

1. Determine the **purpose** of the monitoring. For example, one might establish a monitoring program to: determine injury levels; predict pest population levels or time treatments; or learn something specific about the biology or ecology of the pest or its natural enemies.
2. Determine **which populations** are to be sampled. For example, although there are many predators and parasitoids which could be monitored with respect to the management of most pests, some are more important to sample than others.
3. Decide which **other variables** need to be sampled (e.g., height and frequency of mowing temperature and humidity; soil fertility and moisture levels; kitchen sanitation, etc.)
4. Decide on the **frequency** of the monitoring visits. While once-a-week observation is a common choice, this may need to be varied to suit the season, the weather, the size of the pest population, or other variables. Frequency of visits are usually increased as pest populations approach the injury level.
5. Decide **which sites** should be inspected. High priority areas, or those offering examples of characteristic variation in the system, may be visited most frequently.

6. Determine the **number** of plants or locations to be sampled at each site.
7. Decide upon a **precise sampling procedure**. More than one technique or sample size may have to be tried to determine this. Recording numbers of plants or sites showing damage, and ranking them high, medium, or low; making counts of organisms at specific sites (e.g., the number of caterpillars on the last foot of a branch, five feet above the ground, selected at random on the north, south, east, and west of the tree); and counting or weighing organisms attracted into light or pheromone traps, are some of the many methods available.
8. Devise a **record-keeping system** that is easy and quick to use in the field.
9. Develop a system of **displaying** the information collected for ease in decision-making.
10. **Evaluate** the sampling and decision-making system. For example, one might ask if the treatment actions taken had the desired effect upon the pest population without triggering other problems such as secondary pests, or having undesirable effects upon the applicator or the environment.
11. **Make corrections** in the overall process. Continue to monitor, and fine-tune the system based on information gained from monitoring.

Criteria for Selecting Treatment Strategies

Once the IPM decision-making process is in place, and a pest treatment is deemed necessary, the choice of actual strategy and technique can be made.

Choose strategies that are:

- least-disruptive of natural controls
- least-hazardous to human health
- least-toxic to non-target organisms
- least-damaging to the general environment
- most likely to produce a permanent reduction in the environment's ability to support that pest
- most cost-effective in the short and long term

Summary of Treatment Strategies

A pest management strategy is a series of planned tactics or methods for preventing or suppressing pest populations based on ecological understanding.

The IPM approach takes advantage of the fact that combined strategies for pest management are more effective in the long run than a single strategy. Some strategies are superior to others because they build out the pest, or build in its natural enemies, thus giving long-term suppression or elimination of the pest problem. In contrast, short-term strategies respond to an immediate crisis but do little to prevent the problem from recurring repeatedly. The major strategies, in the order in which they should be considered, are:

A. Design or redesign of the landscape or structure. This includes:

1. Selection of plants, livestock, or structural materials that are:
 - resistant to pests
 - supportive of natural controls
 - enhancing of ecosystem diversity and process
2. Agricultural, landscape, or structural designs that are:
 - conducive to plant health or sound structural maintenance
 - appropriate to the weather, soil, mineral, water, energy, and human resources of the site and the maintenance system

B. Habitat modification or changing the biophysical environment for purposes of:

1. Reduction of pest harborage, food, or other life support requirements.
2. Enhancement of the environment required by the pests' predators, parasites, diseases, antagonists, or competitors.

C. Human behavior changes, including:

1. Horticultural controls and maintenance practices
 - modification of such resource management practices as mowing, cultivating, watering, planting, fertilizing, pruning, mulching, household cleaning, waste management etc.
2. Education
 - modification of aesthetic judgments regarding "cosmetic damage" to fruits and vegetables, manicuring of landscapes, and the visual presence of certain animal species.

Who needs to receive education?

- pest management professionals
- farmers, foresters, landscape and building maintenance personnel, resource managers of every kind
- policy makers and regulatory personnel in public and private institutions and agencies
- the general public

D. Biological controls, including:

1. Conservation of the pests' natural enemies through the proper selection of materials, and the timing and placing of treatments.
2. Augmentation of existing natural enemies by releasing additional numbers of the same species.
3. Inoculation by the repeated reintroduction of effective natural enemies that are available commercially but are unlikely to live from season to season in the natural environment.
4. Importation of the host-specific natural enemies of exotic invaded pests. *Note:* This is the one strategy not available to private individuals or institutions, and must be carried out by government supervised quarantine facilities.

E. Physical controls such as:

- Barriers
- Traps
- Heat, cold, humidity, desiccation, or light
- Electric current
- Mechanical action
- Manual removal
- Others

F. Chemical controls, including:

- Pheromones and other attractants to lure and/or confuse the pest
- Juvenile hormones that arrest pest development
- Repellents
- Allelopathins
- Sterilants or contraceptives to reduce breeding of future generations
- Contact, stomach, and other poisons
- Fumigants
- Combinations of the above (e.g. baits with attractant and stomach poison)
- Others

Key Contacts for Pesticide Information

The following agencies and contacts may be able to assist you with additional information on pesticides and integrated pest management. (These addresses were current as of mid-1998.) Links to the Web sites listed below can also be found on DPR's *H₂O Home to Ocean* Web site at www.cdpr.ca.gov/docs/h2o

California Department of Pesticide Regulation

Environmental Monitoring and Pest Management Branch
830 K Street
Sacramento, CA 95814
(916) 324-4100
www.cdpr.ca.gov

U.S. Environmental Protection Agency, Region 9

Pesticides and Toxic Branch
75 Hawthorne Street
San Francisco, CA 94105
(415) 744-1087
www.epa.gov/region09/toxic/

For the U.S. EPA Region 9 (headquartered in San Francisco) pollution prevention office, which offers grant information, call (415) 744-2190 and (415) 744-2192.

University of California Cooperative Extension

Cooperative Extension offices based on campuses and in individual counties include specialists who provide pest

control advice to organizations and individual consumers. Cooperative extension includes the Master Gardener Program, a volunteer organization that assists home gardeners. For phone numbers, consult the phone directory white pages under county government listings, or go to DPR's Web site at www.cdpr.ca.gov.

County Agricultural Commissioners

Individual county agricultural commissioners provide local enforcement of pesticide use and disposal laws and regulations. For phone numbers and addresses, consult the phone directory white pages under the county government listings, or go to DPR's Web site at www.cdpr.ca.gov.

California Department of Toxic Substance Control (DTSC)

Science, Pollution Prevention and Technology Program

Office of Pollution Prevention and Technology Development
P.O. Box 806
Sacramento, CA 95812-0806

Karl Wilhelm
Pollution Prevention
(916) 322-3670

DTSC provides information on household hazardous waste disposal programs:

www.calepa.cahwnet.gov/dtsc/dtsc.htm

**Central Contra Costa Sanitary District
(Central San)**

5019 Imhoff Place
Martinez, CA 94553
(925) 229-7329
www.centralsan.org

Central San has an extensive outreach and education program, focusing on integrated pest management. The district's programs are highlighted at length in this Appendix.

The Bio-Integral Resource Center (BIRC)

P.O. Box 7414
Berkeley, CA 94707
(510) 524-2567
www.igc.apc.org/birc/

BIRC provides information and publications on least-toxic methods for managing unwanted pests.

National Pesticide Telecommunication Network (NPTN)

Department of Agricultural Chemistry
Oregon State University
Corvallis, OR 97331-7301
(800) 858-7378
www.calepa.cahwnet.gov/dtsc/dtsc.htm

NPTN operates a toll-free hotline, staffed by toxicologists, to provide the general public with tips for correctly using pesticides, especially household and professionally-applied pesticides and referrals for laboratory analyses and investigation of pesticide incidents.

Additional Web Site Information

Here is a partial list of Web sites with information on pesticides and IPM. Web addresses were current as of August 1998. Links to the Web sites below can also be found on the *H₂O Home to Ocean* Web site at www.cdpr.ca.gov/docs/h2o

California Department of Pesticide Regulation (DPR)

www.cdpr.ca.gov

DPR has set up an *H₂O Home to Ocean* Web site at www.cdpr.ca.gov/docs/h2o. An electronic version of this workbook (including the logo, brochures, and other materials) is available there. DPR's Web site at www.cdpr.ca.gov also offers news releases and fact sheets on pesticide storage, disposal and IPM. Also available is the DPR publication "Suppliers of Beneficial Organisms in North America," a directory of more than 140 "good bug" dealers. Other Web site information includes a detailed survey and report on school IPM programs, reduced-risk pest management grants and awards, and links to pesticide agencies and programs nationwide.

U.S. Environmental Protection Agency

www.epa.gov/pesticides

Pesticide publications, including "Citizens Guide to Pest Control and Pesticide Safety" and "Healthy Lawn, Healthy Environment" can be downloaded from this site.

**University of California, Davis
Cooperative Extension,
Master Gardener Program**

pom44.ucdavis.edu/masgar.html#links

“Helpful Links for the Consumer and Backyard Grower,” including home and landscape pest notes from the UC Statewide IPM Project, various county master gardener program details and brochures, fact sheets, and links to horticultural Web sites are available.

**California Master Gardener programs with
online information**

www.mastergardeners.org/

The Bio-Integral Resource Center (BIRC)

www.igc.apc.org/birc/

BIRC provides information and publications on least-toxic methods for managing unwanted pests.

GardenWeb

www.gardenweb.com

Reference resources and links on gardening topics, including an calendar where you can look up garden events in your area.

Blue Thumb Program

www.awwa.org/bluethum.htm

The American Water Works site provides a sample water quality and consumer education program, including logos, brochures, and other collateral materials.

**Cornell University Cooperative Extension
Pesticide Management Education Program
(PMEP) Homepage**

pmep.cce.cornell.edu/

PMEP “promotes the safe use of pesticides for the user, the consumer, and the environment.” PMEP serves as a pesticide information center for college and field extension staff, as well as growers, commercial applicators, pesticide formulators/distributors, environmental and conservation groups, and private citizens.

“Guide to Pest Management Around the Home,” Cornell University Cooperative Extension:

[http://pmep.cce.cornell.edu/
recommends/homerecommends-lib/
menu1.html](http://pmep.cce.cornell.edu/recommends/homerecommends-lib/menu1.html)

Exttoxnet

www.ace.orst.edu/info/exttoxnet

Site maintained by several universities provides extensive information on the toxicology of pesticides.

**U.S. Department of Agriculture National
Integrated Pest Management Network**

[www.reeusda.gov/agsys/nipmn/
index.htm](http://www.reeusda.gov/agsys/nipmn/index.htm)

**University of Minnesota’s “IPM World
Textbook”**

ipmworld.umn.edu/

**Purdue University Center for Urban and
Industrial Pest Management**

[www.entm.purdue.edu/Entomology/
UrbanCenter/centerinfo.html](http://www.entm.purdue.edu/Entomology/UrbanCenter/centerinfo.html)

Integrated Pest Management in Schools

[galileo.vigoco.k12.in.us/users/gendpt/
ipm.htm](http://galileo.vigoco.k12.in.us/users/gendpt/ipm.htm)